COLEX-800 Series Operations Manual

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Introduction.

The COLEX-800 is designed to provide a truly expandable Z80 based computer for system integrators and other OEMs. This Colex computer uses the industry standard Z80 microprocessor and the industry standard STD bus. The combination of these two well established computer concepts gives the Colex customer a wide range of available software and hardware which is compatible with the COLEX-800.

The COLEX-800 family uses the CP/M 3.0 operating system, which is the newest release of the operating system most widely used today. This new system is fully compatible with earlier versions, and allows the user access to several thousand different programs for applications ranging from business, to laboratory, to personal productivity, to industrial automation, and on and on. The 3.0 version of CP/M adds truly professional features such as date and time stamping to records and improved user interface, it also allows more memory to be effectively used by the Z80 computer than was originally planned by the chip designers, thus the Colex system supports 131,072 bytes of main memory. This is 4 times the usual 64K. This results in very significant performance improvements and additional user memory space especially in Hard Disk systems.

The COLEX-800 family contains the following features as key elements:

        Z80 processor operating at 4.0 MHz
        131,072 bytes (characters) of dynamic memory
        2 Centronics printer interfaces
        A Modem interface
        A video display or serial printer interface
        1 or 2 - 5.25" floppy disk units of 758 Kilobytes each
        10 megabyte hard disk (optional)
        built-in video display (optional)
        Cartridge tape backup (optional)
        68000/UNIX upgrade path

1.1 CP/M operating system

The COLEX-800 is shipped with a fully configured version of the CP/M 3.0 operating system. This configuration supports all the I/O ports of the basic computer, plus the optional built-in serial interface. One feature of CP/M 3.0 is the LRU, Least-Recently Used buffer. This keeps in 2 banks of ram memory the last 128K bytes of data last read from the disks, this speeds execution of programs such as Wordstar which make extensive use of overlays. The BIOS for the CP/M 3.0 is available to those who need to make modifications for special applications. Contact your local Colex office for more details on the BIOS program.

1.2 STD bus

The STD bus was first released in 1978. Now a proposed standard from the American IEEE (P691), the bus forms the basis of the highest volume standardized bus card family today. Advances in technology have allowed significantly increased densities on the basic card so that today the Colex computer can be built with 4 times the memory in less than half the space of an equivalent machine built only 3 years ago. Colex also has made significant innovations in proprietary logic to expand the bus beyond the original limitations, without losing STD bus compatibility. The basic COLEX-800 can be expanded in I/O and memory functions with Colex cards such as voice output (WORDS), more serial I/O interfaces (SIO4 or PSIO), Video displays (CRT and IGDC), dedicated slave processors (Slave) or parallel TTL I/O (PIO2). New products now in design will further expand the system's capabilities. Also, other companies offer products which will plug into to the 6 free slots of the COLEX-800. Equally important, the COLEX-800 can easily be expanded from a dual Floppy system into a 10 Megabyte hard disk system, or more Floppy drives can be added.

Even the central processor of the system can be replaced with the new generation of 16/32 bit internal data path machines. The Colex 68000 card is one example. With this card, the system can be upgraded to full single user UNIX or CP/M-68K. This adds a significant increase in performance without loss of the cost savings of the STD bus cost. The Colex design of the 68000 and 128K ram cards allow 16 megabytes of data to be addressed on the STD bus, which previously allowed only 64k.

1.3 Z80A processor, STD-CPUE

The heart of the computer is the STD-CPUE Z80 board. This board contains the Z80 CPU chip and a Read Only Memory (normally 4Kbytes) for initially starting the system. It also contains system control functions including memory refresh, system timing, bank switch and common memory control.

1.4 128K dynamic memory, STD-128RAM

Memory for the system is provided by the 128K (131,072) bytes memory board. Two banks of 8-64K ram chips are used on the card, the bank select logic is controlled by the MCSYNC output from the CPUE card. Six kilobytes of the memory is reserved as common, enabled by MEMEX, used by the operating system for inter-bank control. The card can be expanded 256K bytes on the same card.

1.5 I/O interfaces, STD-PSIO

The STD-PSIO card interfaces the COLEX-800 to external I/O devices. There are 2 serial channels for virtually any type of serial protocol, plus a parallel interface IC which can be used for a wide range of timing and control functions. The standard COLEX-800 uses the parallel port for printer interfaces.

The board uses the Z80-SCC chip for serial I/O which includes software baud rate generation, and the Z80-CIO chip for the parallel interface. Both of these chips offer a wide range of programmable options.

1.5.1 Connection for Centronics printers

The 20 bit parallel interface on the PSIO card is programmed for connecting the computer to any Centronics compatible printer. The CP/M system supports this interface as the LST device. The pinout matches the lower 25 pins of the standard 36 pin Centronics interface. This way a cable can simply be built by crimping the upper 25 pins of a 36 pin male connector to a 25 pin cable.

Connector J5 is the LST printer port. Connector J6 is the auxillary printer port. This allows for example a letter printer and a dot matrix printer to be connected to the computer at the same time.

1.5.2 Connection for a Modem (Serial Printer)

A serial port with the configuration 'DTE' is provided on connector J14. This allows direct connection to a standard modem. This port may also be used with serial printers if a cable is used which changes the 'DTE' pinning into 'DCE'.

1.5.3 Connection for a Video display

Connector J13 is provided for use of the system with an external terminal. The 'DCE' pinout of this connector matches directly with all standard terminals. The standard baud rate is 9600 baud.

1.6 Floppy disk drives

The COLEX-800 uses high density Teac 55F disk drives which store 758 Kilobytes of data on each 5.25" diskette. Data is written in double density format, on both sides, and with 96 tracks per inch. A high quality Colex Floppy disk controller board assures reliable data storage. A total of 160 tracks with 10 sectors of 512 bytes each are used. Either 1 or 2 floppy disk drives may be specified to be supplied with the system. The controller can support up to 4 drives.

1.7 Floppy disk controller STD-FLP2

Control and data encoding/decoding of the floppy disk is done by the FLP2 card. It uses the WD1797 controller chip with matching data separation chips. DMA transfers are used between the disk and memory, allowing fullest use of the processor, and faster disk transfer rates.

1.8 10 megabyte hard disk

The Colex system can be supplied with a 10 Megabyte (formatted capacity) TEAC 412 winchester Hard disk. This disk holds the equivalent of 13 floppy disks, and it improves disk access time significantly. The effective storage capacity of the hard disk is actually more than 13 floppy disks since common programs are stored only once. CP/M 3.0 keeps the directory in ram, thus further increasing throughput. Finally, the disk allocation maps are not stored in the main memory (as in CP/M 2.2) but in the system memory bank. This means that hard disk systems have the same user memory space as floppy systems. A hard disk may be added into a floppy disk system by simply installing a disk drive, Xebec controller, cable and STD-SASI board. If the red light need not be visible, then no modifications are required to the mechanics of the system.

1.9 Tape cartridge

For straightforward and semi-automatic backup or archiving of the data on floppy disk or hard disks, Colex will offer a 20 Megabyte Tape drive which can be installed onto the COLEX-800. This drive allows the user to copy the entire contents of the hard disk onto a high density digital version of the Philips cassette in less than 10 minutes, without manual intervention. The floppy disk procedure for complete backup requires manual exchange of up to 13 disks. This feature is now in development. Contact Colex for delivery information.

1.10 Built-in video display STD-CRT

The Colex system can be expanded to have a VT52 upward compatible video display interface built-in. The advantages of this solution are that one serial interface otherwise used for the terminal becomes available for a second printer or other device, and that the built-in controller operates at a much higher data transfer rate. The Colex STD-CRT card contains it's own processor which relieves the system's Z80 from display oriented tasks. The features of this interface exceed that of the VT52, and match those of the Heath/Zenith H19, which most install programs support. The Video display option comes with a detached VT100 style keyboard which uses a telephone like cord for connection to the system.

The COLEX STD-CRT video card is installed into any free slot in the STD bus backplane, the video connector is installed into J16, this is then wired to any standard video monitor. The keyboard connector is installed into J15, this 5 pin 'DIN' connector mates with the cable on the serial keyboard. The system software automatically uses the STD-CRT card if it is installed.

1.11 Expansion slots

The COLEX-800 was designed for expandability. The basic unit has 6 STD bus slots free for user expansion. The power supply can provide up to 8 Ampere for these extensions. In the hard disk version, 5 Ampere is available for the 5 free slots.

1.12 68000 based COLEX systems

A higher performance version of the COLEX-800 is the 68000 based system. This system uses UNIX version 3.0 together with a slave Z80 computer operating with CP/M 2.2. This powerful combination allows all CP/M software to be used together with the new UNIX based software, thus providing a smooth upgrade path from 8 to 32 bit systems. Colex uses the same STD bus concept in these systems, this means maximum flexibility in the choice of expansion cards and assures low system cost. Ask for more details on the Colex 68000 based system product line.

2.0 Setting up the COLEX-800 system

2.1 Connecting the serial terminal

Using a 25 pin male connector, and a 25 pin male or female connector which matches your terminal, connect the terminal of your choice to the COLEX-800. The terminal connector is J13. Colex does not recommend any particular type of display unit, but the terminal chosen should be supported by the applications software you wish to use. Check the list of terminals in the install program for your intended package.

The COLEX-800 connector J13 is wired to match 95% of all terminals available which have an RS232 interface. This should be a simple ´one to one´ connection, in which all pins on the system are connected to the same pins on the terminal. The STD-PSIO manual, which is attached, can be referenced for more details on this connection.

The standard baud rate used is 9600 baud, full duplex. Set your terminal to this speed. Also, as no parity is used, set your terminal to ignore parity. The system supports XON/XOFF, so the terminal may use these codes to control the rate of characters from the system, use the ´device´ utility to enable XON/XOFF. This can be done at power-on time automatically by generating a file called ´profile.sub´. Other baud rates in the range of 50 to 19200 may also be selected with profile and the ´device´ utility.

2.2 Connecting a Centronics printer

A cable is required which has a 25 pin male connector on the system end, and a 36 pin male connector on the printer end. Pin one of the 25 pin connector is connected to pin 1 on the printer connector, and the next 24 pins are connected, typically by mass termination, to the alternating 24 pins of the printer connector. This cable is the same as used on most other small computers. The 25 pin connector is plugged into J5 or J6.

2.3 Connecting a Modem

The COLEX-800 connector J14 is wired to match most modems available. This should be a simple ´one to one´ connection, in which all pins on the system are connected to the same pins on the modem. The STD-PSIO manual, which is attached, can be referenced for more details on this connection.

2.4 Connecting power

The computer should be ordered with the power option required by your location. Should you have to change the power supply voltage, you must open the computer, open the power supply and change the strap to either 110 or 220 volt as required. A philips screwdriver is all that is required for this change. Be sure to change the marking on the back panel after doing this.

If the voltage is correct, (the back panel is marked) then insert a grounded cable which matches the local type of plug into the 3 prong standard connector on the back panel.

2.5 Inserting a floppy disk

The floppy disk should be inserted with the top to the left side (write protect notch down). Be sure to handle the floppy disks properly.

3.0 Operation of the COLEX-800

The system will start (boot) automatically from the disk after power is applied. If the system has a hard disk, it is delivered with the CP/M operating system installed and ready for operation. The floppy disk 'BOOT' contains a backup copy of the operating system.

After reset or power-on, the system will wait 5 seconds or until the hard disk (if any) has reached full speed, which ever is longer. If no hard disk is installed, the system will boot as soon as a floppy is inserted into the drive A: (left hand side). If a hard disk is installed, then the system will boot from the hard disk after the delay. Should the user wish to boot from the floppy instead, then the 'ESC' key should be pressed during the initial delay interval.

In floppy disk only systems, the right hand drive is drive B:.

In hard disk systems, the hard disk is drive A: (5 megabytes) and drive B: (5 megabytes), the floppy disk is drive C:. Should a second hard disk be installed using the built in Xebec controller (not a COLEX supplied option) then this would be drive F: and G: (each 1/2 the storage of the drive). Any second 5.25" floppy disk would be drive D:.

8" Floppy disks

All systems allow the addition of an 8" drive for transfering single density, single sided IBM standard diskettes. An extra cable is required for this modification (not supplied by COLEX). See appendix D. This drive is drive E: in hard disk systems, and drive C: in floppy systems. The drive must be strapped for unit DS3.

At power-on, a test is made of the operation of the system memory, I/O ports and EPROM. Should any error occur, then the system will attempt to send a message to the terminal indicating which board is defective.

CP/M 3.0 is supplied with the system. Please refer to the CP/M manual included for more details on the system.

3.1 Formatting disks

To format a hard disk the program ´WFORMAT´ should be started. This program is supplied on the installation diskette. The program is self explanatory and will lead the user through all steps. There are two versions of the hard disk format section. For clearing the disk, the USER option is selected, which does not alter factory/system integrator specified information on disk size and features. The format program automatically tests the hard disk after it is formatted to de-allocate defective sectors which normally develop over time. The system integrator opton can de-allocate after formatting any tracks found to be bad as well as those specified by the disk drive vendor. The hard disk format program also allows the system integator to install new or larger disk drives onto the system, without modification to the BIOS.

Floppy disks are formatted using the ´FORMAT´ program. The user will be prompted on which drive should be used, and the density. The most typical response should be ´2c:,q´, this will format the floppy (in a -850 system) with the maximum storage space, and will then return to the operating system. The floppy may then be initialized with a bootstrap loader and the operating system. Use ´copysys´ to transfer both programs to the new diskette.

3.2 System generation of hard disk systems

A submit file is included on the installation disk to simplify the installation procedure. Should a hard disk require initialization, then insert the supplied floppy disk, perform reset and press the key ´ESCape´ in less than 5 seconds. This will boot from the floppy a special version of the CP/M 3.0 OS which has the floppy as drive A:, and the hard disk as C: and D:.

Next type in: "SUBMIT INSTALL". the procedure will require about 20 minutes. The hard disk will be totally erased and reformatted. Should you not wish to erase existing data, then answer ´N´ to the formatter confirmation prompt.

When the copy is complete, store the installation disk in a safe place and continue working.

The COPYSYS program is replaced by the PUTCPM3 program for the hard disk version.

3.3 Backup copies

Always keep a backup of your work. See the SET command and the PIP command for details on the ARCHIVE options to allow sequential backing up of your software. The -850 systems includes a backup disk for regenerating the hard disk system.

4.0 Trouble shooting the system

      A number of common problems can be solved without calling for service if the suggestions here are followed. Some are understandable by the layman, others require some tools. Note that any modification or repair work done on the COLEX computer (except that done by qualified COLEX repair staff) will void the warranty.

- No power.

           Check the fuse, and the AC power input cord. The power supply has internal fuses also which should never blow.

- Floppy disk doesn't boot. (-820 systems)

           Be sure your disks have CP/M on them. Use ´copysys´ to install CP/M on your diskettes

- Access to a non-existent drive.

           Will time out after several seconds.

APPENDIX A.

INTERNAL BOARD STRAPPING

Each card in the system has several strapping options for use in a wide variety of applications. In the COLEX-800 systems, the strapping is as shown in the following tables. Please refer to the appropriate board manual for more details on the significance of the strapping options.

STD-CPUE

        Address at power on: 0000H (4Kb EPROM)
        U1 contains system boot EPROM (Part No. 72-05-201)
        J2: 11-12, 2-4, 7-8
        J8: 1-2

STD-128DRAM

        Populated with 128K RAM
        Address banks 4,5 (64k each bank)
        Expansion option to 256K in banks 6,7
        U13 row is bank 4
        U14 row is bank 5
        J1: 1-2, 3-4, 5-6, 7-8
        J2: see J4
        J3: 3-4
        J4: 1 to J2 pin 1*
        J5: Open

*note early systems may have the soldered wire connection:

        J4 pin 4 to U46 pin 18
        then, no jumpers may be added to J2

STD-PSIO

        Address of ports is:
            SCC DCE port status : 1   Channel A   J13
                         data : 3
            SCC DTE port status : 0   Channel B   J14
                           data   : 2
            CIO port : 4-7
        IOEXP line is decoded as : 0
        J2: 1-2, 3-4, 5-6, 7-8, 9-10, 11-12
        J3: 3-4, 7-8, 17-18, 21-22
        J4: 1-2, 3-8, 6-10
        J5: Open
        J6: Open
        J7: Open

STD-FLP2

> Address is E0
> J2: Open
> J4: 1-2
> J5: Open
> J6: 2-3
> J7: 2-3, 1-4
> J8: 1-2, 5-6
> J9: Open
> The 5.25" floppy cable connects to pins 17-50 of the J3 connector, pin 1 of the cable mates to pin 17 of J3.

STD-SASI

> Address is A0
> J2: 1-2, 3-4, 5-6, 7-8, 11-12
> JA: Open

STD-CRT

> Address is DC
> J2: 5-6
> J3: (internal use only, do not change)

Sequence of card positions: (slot 1 is left side)

	COLEX-820	COLEX-850
STD-FLP2	2	1
STD-SASI		2
STD-128DRAM	3	3
STD-PSIO	4	4
STD-CPUE	5	5

No gaps may exist between the cards.

SYSTEM CONNECTIONS

Standard connections (all 25 pin female ´D´ type connections).

CP/M device	Connector	Description
CENTR1	J5	Centronics printer interface.
CENTR2	J6	Auxillary Centronics printer interface.
EXTCRT	J13	Display terminal (DCE).
SERIAL	J14	Modem/serial printer interface (DTE).
INTCRT {	J15	Serial keyboard interface (5 pin DIN).
{	J16	Video connection (75 ohm BNC).

Pin	J14	J13	J5	J6	J15
1	ground	ground	/STROBE	/STROBE	+5 V
2	Transmit data	Receive data	data 0	data 0	KB data
3	Receive data	Transmit data	1	1	Ground
4	RTS out	RTS in	2	2	Chassis
5	CTS in	CTS out	3	3	Bell/LED
6	DSR in	DSR out	4	4	
7	ground	ground	5	5	
8	–	–	6	6	
9	–	–	7	7	
10	–	–	–	–	
11	–	–	BUSY	BUSY	
12	–	–	–	–	
13	–	–	–	–	
14	–	–	ground	ground	
15	sync I/O	sync I/O	ground	ground	
16	–	–	ground	ground	
17	clock I/O	clock I/O	ground	ground	
18	–	–	ground	ground	
19	–	–	ground	ground	
20	DTR out	DTR in	ground	ground	
21	–	–	ground	ground	
22	–	–	ground	ground	
23	–	–	ground	ground	
24	–	–	ground	ground	
25	clock I/O	clock I/O	ground	ground	

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2.0 Setting up the COLEX-800 system

2.1 Connecting the serial terminal

Using a 25 pin male connector, and a 25 pin male or female connector which matches your terminal, connect the terminal of your choice to the COLEX-800. The terminal connector is J13. Colex does not recommend any particular type of display unit, but the terminal chosen should be supported by the applications software you wish to use. Check the list of terminals in the install program for your intended package.

The COLEX-800 connector J13 is wired to match 95% of all terminals available which have an RS232 interface. This should be a simple 'one to one' connection, in which all pins on the system are connected to the same pins on the terminal. The STD-PSIO manual, which is attached, can be referenced for more details on this connection.

The standard baud rate used is 9600 baud, full duplex. Set your terminal to this speed. Also, as no parity is used, set your terminal to ignore parity. The system supports XON/XOFF, so the terminal may use these codes to control the rate of characters from the system, use the 'device' utility to enable XON/XOFF. This can be done at power-on time automatically by generating a file called 'profile.sub'. Other baud rates in the range of 50 to 19200 may also be selected with profile and the 'device' utility.

2.2 Connecting a Centronics printer

A cable is required which has a 25 pin male connector on the system end, and a 36 pin male connector on the printer end. Pin one of the 25 pin connector is connected to pin 1 on the printer connector, and the next 24 pins are connected, typically by mass termination, to the alternating 24 pins of the printer connector. This cable is the same as used on most other small computers. The 25 pin connector is plugged into J5 or J6.

2.3 Connecting a Modem

The COLEX-800 connector J14 is wired to match most modems available. This should be a simple 'one to one' connection, in which all pins on the system are connected to the same pins on the modem. The STD-PSIO manual, which is attached, can be referenced for more details on this connection.

2.4 Connecting power

The computer should be ordered with the power option required by your location. Should you have to change the power supply voltage, you must open the computer, open the power supply and change the strap to either 110 or 220 volt as required. A philips screwdriver is all that is required for this change. Be sure to change the marking on the back panel after doing this.

If the voltage is correct, (the back panel is marked) then insert a grounded cable which matches the local type of plug into the 3 prong standard connector on the back panel.

2.5 Inserting a floppy disk

The floppy disk should be inserted with the top to the left side (write protect notch down). Be sure to handle the floppy disks properly.

3.0 Operation of the COLEX-800

The system will start (boot) automatically from the disk after power is applied. If the system has a hard disk, it is delivered with the CP/M operating system installed and ready for operation. The floppy disk 'BOOT' contains a backup copy of the operating system.

After reset or power-on, the system will wait 5 seconds or until the hard disk (if any) has reached full speed, which ever is longer. If no hard disk is installed, the system will boot as soon as a floppy is inserted into the drive A: (left hand side). If a hard disk is installed, then the system will boot from the hard disk after the delay. Should the user wish to boot from the floppy instead, then the 'ESC' key should be pressed during the initial delay interval.

In floppy disk only systems, the right hand drive is drive B:.

In hard disk systems, the hard disk is drive A: (5 megabytes) and drive B: (5 megabytes), the floppy disk is drive C:. Should a second hard disk be installed using the built in Xebec controller (not a COLEX supplied option) then this would be drive F: and G: (each 1/2 the storage of the drive). Any second 5.25" floppy disk would be drive D:.

8" Floppy disks

All systems allow the addition of an 8" drive for transfering single density, single sided IBM standard diskettes. An extra cable is required for this modification (not supplied by COLEX). See appendix D. This drive is drive E: in hard disk systems, and drive C: in floppy systems. The drive must be strapped for unit DS3.

At power-on, a test is made of the operation of the system memory, I/O ports and EPROM. Should any error occur, then the system will attempt to send a message to the terminal indicating which board is defective.

CP/M 3.0 is supplied with the system. Please refer to the CP/M manual included for more details on the system.

3.1 Formatting disks

To format a hard disk the program ´WFORMAT´ should be started. This program is supplied on the installation diskette. The program is self explanatory and will lead the user through all steps. There are two versions of the hard disk format section. For clearing the disk, the USER option is selected, which does not alter factory/system integrator specified information on disk size and features. The format program automatically tests the hard disk after it is formatted to de-allocate defective sectors which normally develop over time. The system integrator opton can de-allocate after formatting any tracks found to be bad as well as those specified by the disk drive vendor. The hard disk format program also allows the system integator to install new or larger disk drives onto the system, without modification to the BIOS.

Floppy disks are formatted using the ´FORMAT´ program. The user will be prompted on which drive should be used, and the density. The most typical response should be ´2c:,q´, this will format the floppy (in a -850 system) with the maximum storage space, and will then return to the operating system. The floppy may then be initialized with a bootstrap loader and the operating system. Use ´copysys´ to transfer both programs to the new diskette.

3.2 System generation of hard disk systems

A submit file is included on the installation disk to simplify the installation procedure. Should a hard disk require initialization, then insert the supplied floppy disk, perform reset and press the key ´ESCape´ in less than 5 seconds. This will boot from the floppy a special version of the CP/M 3.0 OS which has the floppy as drive A:, and the hard disk as C: and D:.

Next type in: "SUBMIT INSTALL". the procedure will require about 20 minutes. The hard disk will be totally erased and reformatted. Should you not wish to erase existing data, then answer ´N´ to the formatter confirmation prompt.

When the copy is complete, store the installation disk in a safe place and continue working.

The COPYSYS program is replaced by the PUTCPM3 program for the hard disk version.

3.3 Backup copies

Always keep a backup of your work. See the SET command and the PIP command for details on the ARCHIVE options to allow sequential backing up of your software. The -850 systems includes a backup disk for regenerating the hard disk system.

4.0 Trouble shooting the system

A number of common problems can be solved without calling for service if the suggestions here are followed. Some are understandable by the layman, others require some tools. Note that any modification or repair work done on the COLEX computer (except that done by qualified COLEX repair staff) will void the warranty.

- No power.

Check the fuse, and the AC power input cord. The power supply has internal fuses also which should never blow.

- Floppy disk doesn't boot. (-820 systems)

Be sure your disks have CP/M on them. Use 'copysys' to install CP/M on your diskettes

- Access to a non-existent drive.

Will time out after several seconds.

APPENDIX A.

INTERNAL BOARD STRAPPING

Each card in the system has several strapping options for use in a wide variety of applications. In the COLEX-800 systems, the strapping is as shown in the following tables. Please refer to the appropriate board manual for more details on the significance of the strapping options.

STD-CPUE

    Address at power on: 0000H (4Kb EPROM)
    U1 contains system boot EPROM (Part No. 72-05-201)
    J2: 11-12, 2-4, 7-8
    J8: 1-2

STD-128DRAM

    Populated with 128K RAM
    Address banks 4,5 (64k each bank)
    Expansion option to 256K in banks 6,7
    U13 row is bank 4
    U14 row is bank 5
    J1: 1-2, 3-4, 5-6, 7-8
    J2: see J4
    J3: 3-4
    J4: 1 to J2 pin 1*
    J5: Open

*note early systems may have the soldered wire connection:

    J4 pin 4 to U46 pin 18
    then, no jumpers may be added to J2

STD-PSIO

    Address of ports is:
        SCC DCE port status : 1   Channel A   J13
                        data : 3
        SCC DTE port status : 0   Channel B   J14
                        data : 2
        CIO port : 4-7
    IOEXP line is decoded as : 0
    J2: 1-2, 3-4, 5-6, 7-8, 9-10, 11-12
    J3: 3-4, 7-8, 17-18, 21-22
    J4: 1-2, 3-8, 6-10
    J5: Open
    J6: Open
    J7: Open

STD-FLP2

        Address is E0
        J2: Open
        J4: 1-2
        J5: Open
        J6: 2-3
        J7: 2-3, 1-4
        J8: 1-2, 5-6
        J9: Open
        The 5.25" floppy cable connects to pins 17-50 of the J3
            connector, pin 1 of the cable mates to pin 17 of J3.

STD-SASI

        Address is A0
        J2: 1-2, 3-4, 5-6, 7-8, 11-12
        JA: Open

STD-CRT

        Address is DC
        J2: 5-6
        J3: (internal use only, do not change)

Sequence of card positions: (slot 1 is left side)

	COLEX-820	COLEX-850
STD-FLP2	2	1
STD-SASI		2
STD-128DRAM	3	3
STD-PSIO	4	4
STD-CPUE	5	5

No gaps may exist between the cards.

APPENDIX B

SYSTEM CONNECTIONS

Standard connections (all 25 pin female 'D' type connections).

CP/M device	Connector	Description
CENTR1	J5	Centronics printer interface.
CENTR2	J6	Auxillary Centronics printer interface.
EXTCRT	J13	Display terminal (DCE).
SERIAL	J14	Modem/serial printer interface (DTE).
INTCRT {	J15	Serial keyboard interface (5 pin DIN).
{	J16	Video connection (75 ohm BNC).

Pin	J14	J13	J5	J6	J15
1	ground	ground	/STROBE	/STROBE	+5 V
2	Transmit data	Receive data	data 0	data 0	KB data
3	Receive data	Transmit data	1	1	Ground
4	RTS out	RTS in	2	2	Chassis
5	CTS in	CTS out	3	3	Bell/LED
6	DSR in	DSR out	4	4	
7	ground	ground	5	5	
8	-	-	6	6	
9	-	-	7	7	
10	-	-	-	-	
11	-	-	BUSY	BUSY	
12	-	-	-	-	
13	-	-	-	-	
14	-	-	ground	ground	
15	sync I/O	sync I/O	ground	ground	
16	-	-	ground	ground	
17	clock I/O	clock I/O	ground	ground	
18	-	-	ground	ground	
19	-	-	ground	ground	
20	DTR out	DTR in	ground	ground	
21	-	-	ground	ground	
22	-	-	ground	ground	
23	-	-	ground	ground	
24	-	-	ground	ground	
25	clock I/O	clock I/O	ground	ground	